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Biomechanical outcomes following autologous chondrocyte implantation: comparison of traditional and accelerated approaches to post-operative rehabilitation.

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Purpose: Patients spend up to 12 weeks partial weight bearing (PWB) following autologous chondrocyte implantation (ACI), a relatively long period of altered gait patterns. It is unknown how these PWB programmes affect the recovery of gait function and subsequent long-term graft outcome. We sought to investigate the return of gait normality following ACI, with respect to 'traditional' and 'accelerated' approaches to load bearing rehabilitation.
Methods and Materials: Gait analysis was performed at three months post-surgery in this randomized controlled study design, in 52 patients walking at comfortable, self-selected speeds, as well as a matched control group.
Results: Normalized peak external knee adduction and flexion moments were significantly different between accelerated and traditional groups ($p<0.05$). Comparison of each rehabilitation group with their respective control group revealed a significant difference in peak knee adduction and flexion moments for the traditional group ($p<0.05$). However, there was no difference for accelerated patients ($p>0.05$), which may demonstrate the return to a more 'normal' knee loading pattern. Peak external vertical ground reaction force parameters and knee kinematics between both rehabilitation groups and their respective control groups were significantly different at three months post-surgery ($p<0.05$).
Conclusions: An 'accelerated' load bearing approach that reduces the length of time spent ambulating on crutches is not detrimental to post-operative gait patterns, and may speed up the recovery of normal gait function. Patient follow-up is required to see if long-term graft outcome is affected by the recovery time course of normal gait function, and/or abnormal loading mechanics in gait.

6.6

Implementation of rehabilitation exercises for patients treated with characterized chondrocyte implantation and microfracture.

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Purpose: To evaluate the implementation and compliance with a specific standardized rehabilitation protocol post surgical cartilage repair.
Methods and Materials: A total of 95 physiotherapists received instructions for implementing and reporting on the standardized rehabilitation protocol. The protocol describes the rehabilitation by goals and specific restrictions. How long, how frequent and intense exercises were to be performed was not strictly imposed. The reporting rate and the physiotherapy were examined over a post-operative period of 12 months. Variables to report on included clinical examination, exercises, mobilization modalities, electrotherapy and thermotherapy.
Results: During the first 3 months all physiotherapists reported, from which 85% at least once month. The following 3 months 50% of physiotherapists reported, from which 41% once a month. For the last 6 months only 27% reported from which 15% once a month. Due to the low report rate after 3 months the physiotherapy was not analyzed. The first 3 months the physiotherapists reported 4 modalities per session on an average of 3.3 sessions per week. The preference and timing of the modalities were highly consistent with the protocol in both groups. Moreover the modalities used for both treatment groups were not significantly different over 12 weeks. However within specific weeks minor differences for time spent on gait re-education and active mobilization exercises were observed.
Conclusions: Overall, the rehabilitation protocol was implemented in a similar way in both treatment arms. The physiotherapists followed and reported the protocol with an excellent compliance the first 3 months. Follow up to 12 months showed a progressive decline in reporting.

6.7

Evaluation of the results of a biodegradable scaffold for treatment of cartilage defects using T2 mapping techniques

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Purpose: The purpose of this study was to evaluate the results of a biodegradable scaffold using T2 mapping at selected time intervals over the study period.
Methods and Materials: Materials: Between September 2004 and December 2006, 42 patients underwent biodegradable scaffold implantation for the treatment of symptomatic cartilage defects. This scaffold was used both for primary resurfacing for smaller defects and as backfill and in hybrid combinations for larger defects utilizing standard OATS techniques. Methods: Patients were imaged between 6 and 30 months with standard MRI and T2 mapping techniques to evaluate the quality and natural history of healing with this scaffold.
Results: Preliminary work with T2 mapping has indicated a strong correlation between in vivo focal T2 changes and histologic findings. The color mapping uses collagen content and allows a visual assessment of the healing of the grafts. Over the time period studied, progressive incorporation and maturation of a hyaline like cartilage surface was noted with characteristics similar to surrounding nonpathologic surfaces. Excellent cartilage characteristics were observed the in the patients imaged.
Conclusions: The use of T2 mapping helps objectify the results of cartilage healing in patients undergoing biodegradable scaffold implantation. The results are quite positive and correlate with IKDC scores as time progresses.

9.3

Co-overexpression via rAAV of human sox9 and FGF-2 enhances the repair of articular cartilage defects in vivo

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Purpose: We tested the hypothesis that direct co-overexpression of FGF-2 and sox9 via recombinant adeno-associated virus vectors (rAAV) in osteochondral defects in the rabbit knee joint leads to an improved cartilage repair in vivo.
Methods and Materials: rAAV vectors used were rAAV-lacZ, rAAV-hFGF-2 and rAAV-FLAG-sox9. Osteochondral defects were created in the patellar groove of Chinchilla bastard rabbits Each animal received a combination of rAAV-hFGF-2/rAAV-FLAG-sox9 (10 ul) on one knee (treated defects) and rAAV-lacZ (10 ul) on the contralateral knee (control defects). At 4 months post operation, cartilage repair was assessed based on a scoring system. Points for each category and total score were compared between the groups using a mixed general linear model with repeated-measures analysis of variance. Indirect immunostaining was performed to detect beta-gal, Sox9, the FLAG tag, FGF-2, type-I and type-II collagen.
Results: At 4 months, FGF-2 and FLAG tag expression were present only in the treated defects. Enhanced healing was observed in the treated defects vis a vis the control defects. Improved individual parameter scores were noted for defect filling, matrix staining, cell morphology, architecture, surface, subchondral bone, and tidemark of the treated defects (all $P < 0.001$), with a significantly improved total score ($P < 0.001$). Immunoreactivity to type-II collagen in treated defects was more regular and consistent with the surrounding cartilage whereas type-I collagen staining became less evident.
Conclusions: The results suggest that combined application of therapeutic rAAV may have value in enhancing cartilage repair by direct administration to sites of focal articular cartilage damage.